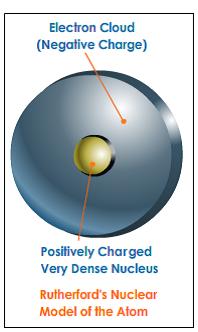
Electrons in Atoms: Light and Quantized Energy

## Is light considered a particle or a wave?

*Although three subatomic particles had been discovered by the early 1900s, the quest to understand the atom and its structure had really just begun. The next step in the process was the pursuit of an understanding of how electrons were arranged in the atom.*

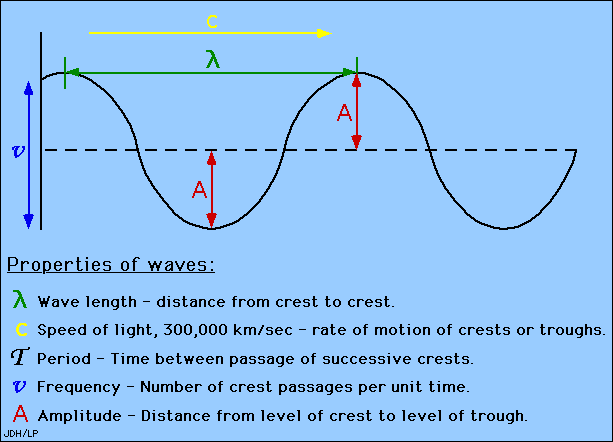
Model 1: Rutherford’s Model of the Atom



Questions:

1. What classic experiment in chemistry is the basis for the Rutherford model of the atom above?
2. Describe Rutherford’s model of the atom. Why did scientists of the day consider his model to be incomplete? What unanswered questions might scientists have had?

In the early 1900s scientists observed that certain elements emitted visible light when heated in a flame. Analysis of the emitted light revealed that an element’s chemical behavior is related to the arrangement of the electrons in its atoms. To understand the nature of atoms, we should first understand the nature of light since it would interact with atoms. Light is a form of energy that exhibits wavelike behavior as it travels through space. All forms of this type of energy are referred to as ***electromagnetic radiation***.

Model 2: Characteristics of Light (Electromagnetic Radiation)

1. What does the dotted line on the diagram above represent considering this diagram is a graph?
2. On the diagram above, determine the label (letter) for the following properties of waves:

\_\_\_\_\_***Wavelength*** – distance between equivalent points on a continuous wave. It is usually expressed in m, cm or nm.

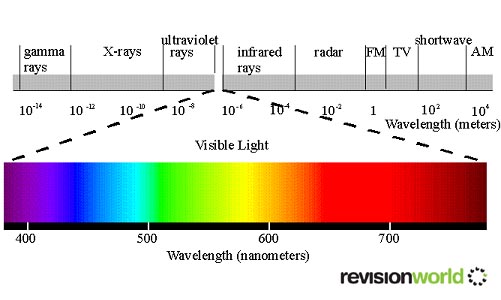
\_\_\_\_\_ ***Speed of light*** – rate of motion of crests or troughs. All electromagnetic waves travel at a speed of 3.00 x 108 m/s in a vacuum.

\_\_\_\_\_ ***Frequency*** – number of waves that pass a given point per second. One hertz, the SI unit of frequency, equals one wave per second. It is expressed as units of waves per second where the term waves is understood. The abbreviation is either Hz or s-1.

\_\_\_\_\_ ***Amplitude*** – distance from origin to crest or from origin to a trough

1. Using your knowledge of the units described in number 3, come up with a formula that relates wavelength, speed of light and frequency. Draw the “magic triangle” for your formula.
2. Now work the problems #1-4 on page 121 of your textbook.

Model 3: The Electromagnetic Spectrum



1. What does the band at the bottom of Model 3 represent?
2. Why do you think the electromagnetic spectrum is called a “continuous” spectrum?
3. Based on Model 3, how would you describe the relationship between:
   1. Wavelength and energy
   2. Frequency and energy